MIL-R-14346A(Ord)
15 September 19[illegible]
SUPERSEDING
MIL-R-14346(Ord)
13 July 195[illegible]

MILITARY SPECIFICATION

RESOLVERS, ELECTRICAL, AC

1. SCOPE

1.1 Scope.- This specification covers the requirements for electrical resolvers operating at frequencies of 60 or 400 cycles for the precision transmission or conversion of angular data (see 6.1).

1.2 Classification.

1.2.1 Nomenclature.- The nomenclature shall consist of the noun i.e., Resolver, followed by a type designation (See 6.2). All resolvers having the same nomenclature shall be mechanically and electrically interchangeable for all military applications. The type designation shall be indicated by a combination of digits and letters Illustrated below is the complete nomenclature for a resolver type 23R32N4:

Resolver	23	R	32	N	4
Noun	Size	Funct.	Imped. Input Wind.	Comp.	Excit.
	(1.2.1.1)	(1.2.1.2)	(1.2.1.3)	(1.2.1.4)	(1.2.1.5)

1.2.1.1 Size.- The size is the maximum diameter in tenths of an inch. If the diameter is not exactly a whole number of tenths, the next higher tenth is used.

1.2.1.2 Function.- The function is identified by the letter R, the designation for resolver.

1.2.1.3 Impedance.- The impedance is the nominal input impedance in hundreds of ohms. If the impedance is not exactly a whole number of hundreds, the next higher hundred is used.

FSC 5990

1.2.1.4 Compensation.- Compensation is indicated by a one-letter symbol as follows

Resistor compensated	R
Winding compensated	W
Resistor and winding compensated	B
Not compensated	N

1.2.1.5 Excitation frequency.- The excitation frequency is identified by one digit as follows

Excitation frequency (cps)	Code
60	6
400	4

2 APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

TT-I-558	Ink, Marking Stencil, Opaque, For Nonporous Surfaces, Metals, Glass, etc.

Military

MIL-V-173	Varnish, Moisture and Fungus Resistant for the Treatment of Communications, Electronic and Associated Electrical Equipment
MIL-P-6906	Plates, Information and Identification
MIL-S-12134	Synchros, Resolvers (Electrical) and Servo Motors, Packaging of
MIL-F-13926	Fire Control Material, General Specification Governing the Manufacture and Inspection of
MIL-R-23417	Resolvers, Electrical, General Specification For

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U. S. Military Property
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts

DRAWINGS

U.S. Army Munitions Command

F7651264	Resolver, Electrical, Type 15R7N4
F7674822	Resolver, Electrical, Type 23R8N4
F7677411	Resolver, Electrical, Type 23R3N4
F7676358	Resolver, Electrical, Type 23R6N6
F7659638	Resolver, Electrical, Type 23R9N6
F7659617	Resolver, Electrical, Type 23R6R4
F7659420	Resolver, Electrical, Type 23R32W4
F7659434	Resolver, Electrical, Type 23R11R6
F7659446	Resolver, Electrical, Type 23R32N4

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.- The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS

Handbook H-28 - Screw-Thread Standards for Federal Services

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402).

CONSOLIDATED CLASSIFICATION COMMITTEE

Consolidated Freight Classification Rules

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Illinois)

3. REQUIREMENTS

3.1 Detail requirements for the individual resolver types.- Detail requirements for resolvers shall be in accordance with Table I and drawing as specified herein for each respective type resolver (see 3.4 and 6.2).

3.2 First article testing. Requirements for the submission of first article samples by the contractor for testing shall be as specified in the contract.

3.3 Design conventions.

3.3.1 Resolver zero.- Resolver zero is defined as the rotor position produced under the following conditions.

3.3.1.1 Resolver zero for rotor excited units.- That position of the rotor for which windings (R1-R3) and (S2-S4) experience minimum coupling (null) and for which the established vector convention is in accordance with Figure 1 and the equations of 3.3.2.1 for positive (counterclockwise) rotation.

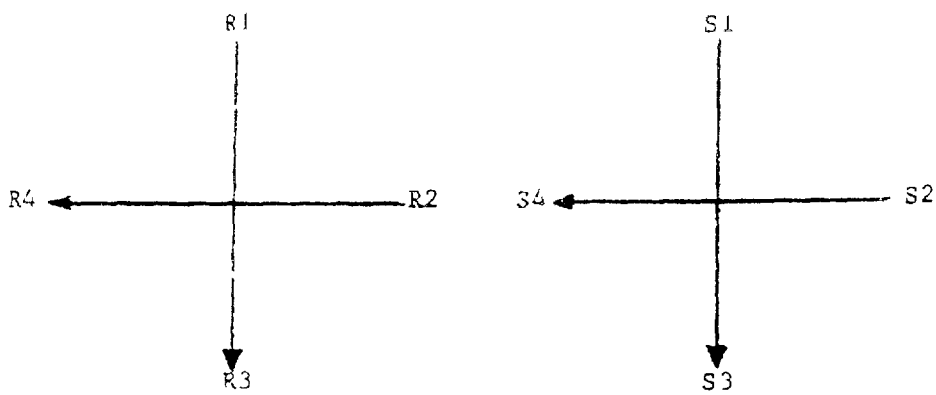


Figure 1

3.3.1.2 Resolver zero for stator excited units.- That position of the rotor for which windings (S1-S3) and (R2-R4) experience minimum coupling (null) and for which the established vector convention is in accordance with Figure 2 and the equations of 3.3.2.2 for positive (counterclockwise) rotation.

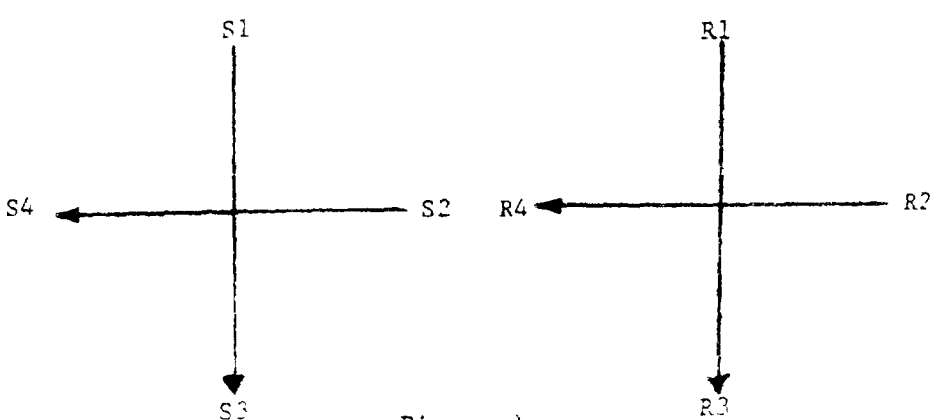


Figure 2

3.3.2 Electrical angle.- The electrical angle theta (θ) is the angle which satisfies the relative magnitudes and polarities of the secondary voltages of an ideal resolver in accordance with the vector convention established in 3.3.1 and with the equations of the following form:

3.3.2.1 Rotor energized units.

$$E(S1\text{-}S3) = KE(R1\text{-}R3)\cos\theta + KE(R2\text{-}R4)\sin\theta$$
$$E(S2\text{-}S4) = KE(R2\text{-}R4)\cos\theta - KE(R1\text{-}R3)\sin\theta$$

Where K = Transformation Ratio

3.3.2.2 Stator energized units.

$$E(R1\text{-}R3) = KE(S1\text{-}S3)\cos\theta - KE(S2\text{-}S4)\sin\theta$$
$$E(R2\text{-}R4) = KE(S2\text{-}S4)\cos\theta + KE(S1\text{-}S3)\sin\theta$$

Where K = Transformation Ratio

NOTE Whenever a winding is referenced in terms of its two enumerated termination letters, e.g., E(S1-S3), E(R1-R3), etc., the direction of the instantaneous voltage vector shall be from the first enumerated letter to the second.

3.3.3 Phase rotation.- Phase rotation shall be considered correct when for counterclockwise rotation of the rotor shaft, the resolver outputs are in accordance with the equations of 3.3.2, or, when tested in accordance with 4.6.7, the voltmeter shall read less than the test voltage.

3.3.4 Units.- Unless otherwise specified, units of measurement shall be as follows:

(a) Angles - degrees, minutes
(b) Potential - volts, rms
(c) Impedance - ohms
(d) Current - amperes, rms
(e) Temperature - degrees centigrade

3.4 Design and construction.

3.4.1 Terminal identification.- The following terminal designations shall be used:

Windings	Marking
Stator Winding	S1-S3, S2-S4
Rotor Winding	R1-R3, R2-R4
Compensating Winding	C1-C3, C2-C4
Compensating Resistor	1-3, 2-4

Terminal designations are such that stator and compensating terminals with like numbers have like polarity when the resolver rotor angle is zero degrees.

3.5 Performance.

3.5.1 Input voltage and frequency.- The resolver shall operate satisfactorily at the input voltage and frequency specified in 3.1.

3.5.2 Test voltage.- Test voltage is the input voltage at which the resolver shall meet the requirements of this specification and shall be as specified in 3.1.

3.5.3 Primary current.- Primary current is the current drawn by the primary when maximum input voltage is applied and the secondaries are open. The maximum input current shall not exceed the specified value of 3.1

3.5.4 Primary power.- Primary power is the power consumed by the primary when maximum input voltage is applied and the secondaries are open. The maximum power consumed by the resolver shall not exceed the specified value of 3.1.

3.5.5 High potential.- Resolvers shall show no evidence of leakage or insulation breakdown between windings and frame and between isolated windings when subjected to the high potential tests.

3.5.6 Insulation resistance.- Resolvers shall have an insulation resistance of 100 megohms (minimum) when a dc voltage is applied between windings and between windings and case.

3.5.7 Dielectric strength.- Resolvers shall show no erratic indication of current in the primary or exhibit a noticeable torque when subjected to the dielectric test voltages and frequencies.

3.5.8 Function error.- The function error of the resolver shall not exceed the value specified in 3.1.

3.5.9 Null voltage.- The fundamental null voltage and the total null voltage shall not exceed the values specified in 3.1 (in millivolts root mean square (rms) per volt (rms) input).

3.5.10 Friction torque.- The amount of torque required to overcome friction shall not exceed the maximum values of 3.1 for the specified temperatures ($23^{o} \pm 5^{o}C$).

3.5.11 Radial play and end play.- Radial play shall not exceed values specified in 3.1 on reversal of ½ pound load. End play shall not exceed the value specified in 3.1 on reversal of 1 pound load.

3.5.12 Brush ring continuity.- Each rotor winding shall show continuity and the change in resistance shall not exceed 5 percent between the high and low measured values when the rotor is turned at a speed not faster than 5 revolutions per minute (rpm) for a minimum of two revolutions in each direction.

3.5.13 Phase shift.

3.5.13.1 Nominal.- The nominal phase shift shall not exceed the specified value of 3.1.

3.5.13.2 Variation due to rotation.- The variation of phase shift as a function of rotor angle shall not exceed the specified value of 3.1.

3.5.13.3 Variation due to voltage.- The total variation of phase shift as a function of input voltage shall not exceed the values specified in 3.1.

3.5.14 Transformation ratio.- The value of the transformation ratio shall be as specified in 3.1.

3.5.14.1 Variation with input voltage.- The variation in transformation with the specified input voltage (see 3.5.1) shall not exceed the limits specified in 3.1.

3.5.14.2 Equality of transformation ratio.- The maximum difference in transformation ratios from primary to secondary and where compensating windings are used from compensator to secondary windings shall not exceed the limits specified in 3.1.

3.5.15 Compensating windings.

3.5.15.1 Null voltage.- The null voltage shall have a fundamental frequency component no greater than 0.10 millivolts root mean square (rms) per volt (rms) input when connected as specified in Figures 21 and 22.

3.5.15.2 Winding phase.- The correct winding phase shall be indicated when the voltmeter reads less than the test voltage and the resolver is connected as shown in Figures 23 and 24.

3.5.15.3 Equality of compensating windings.- When the resolver is connected as shown in Figure 25 the null voltage shall have a fundamental frequency component no greater than 1.0 millivolt (rms) per volt (rms) input.

3.5.15.4 Compensating resistor.- When compensating resistors are applicable they shall conform to the value and tolerance specified in 3.1

3.5.16 Impedance.

3.5.16.1 Rotor impedance, stator open-circuited (Z_{RO}).- Rotor impedance, stator open-circuited, Z_{RO}, shall not exceed the specified limit (see 3.1).

3.5.16.2 Stator impedance, rotor open-circuited (Z_{SO}).- Stator impedance, rotor open-circuited, Z_{SO}, shall not exceed the specified limit (see 3.1).

3.5.16.3 Rotor impedance, stator short-circuited (Z_{RSS}).- Rotor impedance, stator short-circuited, Z_{RSS}, shall not exceed the specified limit (see 3.1).

3.5.16.4 Compensator impedance, rotor open-circuited (Z_{CO}).- Compensator impedance, rotor open-circuited, Z_{CO}, shall not exceed the specified limit (see 3.1).

3.5.17 Perpendicularity of axes.- The angular deviation of the null angles from their true angular position shall not exceed the specified value of 3.1.

3.5.18 Resolver zero marking.- The frame of the resolver shall be permanently marked with an arrow which coincides with an index mark on the rotor shaft at electrical zero within $\pm$ 10°.

3.5.19 Shift of resolver zero.- The change of position of resolver zero with variation of input voltage and frequency shall not exceed the values specified in 3.1.

3.5.20 Harmonic distortion.- Unless otherwise specified, harmonic distortion shall be no greater than 0.1% when connected in accordance with Figure 14 or 15 as applicable.

3.5.21 Radio noise.- Resolvers shall not produce radio noise at a distance three feet from the unit in excess of 2.5 microvolts in the frequency range 0.15 to 65 megacycles and 5 microvolts in the frequency range of 65 to 150 megacycles.

3.5.22 Temperature rise.- The temperature rise of the energized resolver above ambient temperature shall not exceed the limits specified in 3.1.

3.6 Environmental.

3.6.1 Endurance.- All resolvers covered by this specification shall be capable of operating at 1150 ± 50 rpm continuously for 1000 ± 10 hours without failure or evidence of undue wear, deterioration of windings or deposits of distillates.

3.6.2 Vibration.- The resolver shall show no evidence of damage, loose metal chips or other particles of foreign matter and shall operate satisfactorily after having been vibrated in a vertical and horizontal direction for a total amplitude of .010 ± .002 inches at a frequency of 10 to 60 cps with a period of one minute for a total of 8 hours ± 15 minutes.

3.6.3 Shock.- The resolver shall operate satisfactorily after being energized and subjected to 6 blows of 100 G each while the shaft is free to rotate.

3.6.4 Humidity.- The resolver shall show no evidence of rust, blistering, varnish condensation and shall operate satisfactorily after exposure for 240 hours at a temperature of 40 ± 2°C and a relative humidity of 90 to 95 percent.

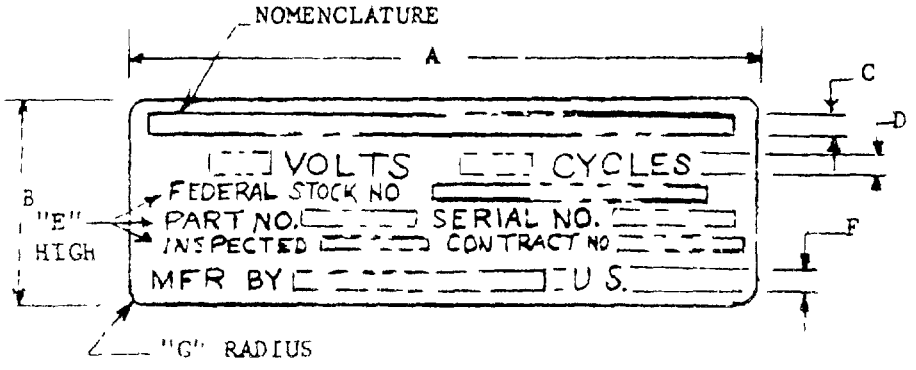
3.6.5 Ambient temperatures.- Resolvers shall be capable of storage without damage in ambient temperatures ranging from -62°C to 100°C. The resolvers shall meet all the specified requirements when operated in the following ambient temperatures: 55°C to 85°C. All resolvers shall conform to the requirements of 3.5.4, 3.5.5 and 3.5.6 after being temperature stabilized for a period of four hours at 125°C.

3.7 Identification.- Resolvers shall be identified with markings conforming to Figure 3 and MIL-P-6906. If identification plates are used they shall be not more than 0.003 inches thick. Other methods of marking are permissable provided they comply with MIL-P-6906.

3.7.1 Legibility of marking.- All marking shall remain legible after completion of all tests.

3.8 Rejects.- Resolvers shall be capable of meeting all the requirements of this specification when tested in accordance with 4.6.27.

3.9 Workmanship.- Workmanship shall be in accordance with the applicable requirements of MIL-F-13926 and shall be of a quality consistent with the best instrument practices and the highest production standards.



TABULATION OF LETTERED DIMENSIONS

SYNCHRO SIZE	A	B	C	D	E	F	G
15	3	3/4	3/32	5/64	3/64	1/16	1/8
23	3 5/8	1	7/64	3/32	3/64	1/16	1/4

NOTES

1. LEGEND SHALL BE CENTRALLY LOCATED HORIZONTALLY AND VERTICALLY.
2. ALL CHARACTERS SHALL BE GOTHIC STYLE EXCEPT SUFFIX LETTER OF TYPE DESIGNATION WHICH SHALL BE LOWER CASE ELITE.
3. NOMENCLATURE, VOLTAGE AND FREQUENCY SHALL BE AS SPECIFIED IN DETAIL REQUIREMENTS ON APPLICABLE FIGURE.
4. SERIAL NUMBERS SHALL BE REQUESTED FROM THE PROCURING AGENCY.
5. CONTRACT NUMBER SHALL BE APPLIED WHEN REQUIRED BY PROCURING AGENCY.

Figure 3. Identification Marking for Resolvers

TABLE I

	REQUIREMENT	UNITS	RESOLVER TYPE DESIGNATION								
			15R7N4	23R3N4	23R9N6	23R6N6	23R8N4	23R6N4	23R11R6	23R32N4	23R32W4
1	Excitation Winding		Stator	Stator	Stator	Rotor	Rotor	Stator	Stator	Stator	Stato
2	Frequency	CPS	400	400	60	60	400	400	60	400	400
3	Input Voltage										
	Maximum	Volts	32	90	50	90	90	55	26	130	130
	Test	Volts	26	60	26	60	60	26	24	60	60
	Minimum	Volts	0 5	10	8	20	20	0.5	2	0 5	0 5
4	Input Current (Max)	Milliamps	57	445	60	170	130	105	28	47	47
5	Input Power (Max.)	Watts	0 27	5 3	0 6	8 0	7 0	0 37	0 13	0 6	0 6
6	D C Resistance										
	Input Winding (± 15%)	Ohms	57	4.84	76 7	250	56	11 0	116	26	97
	Output Winding (± 15%)	Ohms	15	16.2	325 5	280	46	30 5	325 5	170	172
	Comp. Winding (± 15%)	Ohms	NA	NA	NA	NA	NA	NA	NA	NA	189
	Comp Resistor (± 5%)	Ohms	NA	NA	NA	NA	NA	2 2	23 4	NA	NA
7	Transformation Ratio										
	Rotor/Stator (± 0.01)		0 45	1 03	0 99	NA	NA	0 99	0.99	0 99	0 99
	Rotor/Comp (± 0.01)		NA	NA	NA	NA	NA	NA	NA	NA	NA
	Stator/Rotor (± 0.01)		NA	NA	NA	1 00	1 00	NA	NA	NA	NA
8	Equality of Transformation Ratio	% Spread	0.2	0.5	0.5	0 5	0 5	0 2	0 2	0 2	0 10
9	Phase Shift 1/										
	Nominal	Degrees	5 7	1.3	7 7	28 8	4 0	1.0	6 6	0 90	1 9
	Due to Rotation	Degree	±0.5	±0.5	±0 5	±0.5	±0 2	±0 2	±0 2	±0 2	±0 2
	Due to Voltage	Degree	±0 5	±0 5	±0 5	±0 5	±0 2	±0 2	±0 2	±0 2	±0 2
10	Perpendicularity of Axes										
	Rotor	Minutes	±2 5	±5 0	±5.0	NA	NA	±2 5	±2.5	±2 5	±2 5
	Stator	Minutes	NA	NA	NA	±5 0	±5.0	NA	NA	NA	NA
11	Null Voltage										
	Fundamental (Max)	mV/V	0 707	0.53	1.17	0 53	0 53	0 57	0.53	0 35	0 35
	Total (Max.)	mV/V	0.884	1 06	1 74	1.06	1.06	0.78	0 53	0 53	0 53
12	Function Error	Percent	±0.2	±0 2	±0 2	±0.2	±0.2	±0 1	±0 1	±0 1	±0 05
13	Zero Shift of Null Spacing at 0°										
	With Voltage	Minute	±2 0	±3 0	±0 3	±3 0	±3.0	±2 0	±2 0	±2 0	±1 0
	With Frequency	Minute	±1 0	±1 0	±1 0	±1 0	±1 0	±1 0	±1 0	±2 0	±1 0
14	Friction Torque										
	At -22 ± 3°C (Max)	Oz-In	0 2	0 4	0 4	0.4	0 4	0.4	0 4	0 4	0 4
	At -55°C (Max)	Oz-In	0.6	0.8	0 8	0 8	0.8	0 8	0 8	0 8	0 8
15	Brush Contact Resistance (Max)	Ohms	0 8	0 09	1 7	1 3	0 3	0 16	1.7	0 94	0 9
16	Temperature Rise (Max)	Degrees C	30	45	45	65	65	45	45	45	45
17	Weight (Nom)	Oz	6 4	28	28	28	28	28	28	28	28
18	Shaft End Play (Max)2/	Inch	0 0015	0 00'	0 005	0 005	0 005	0.005	0 00'	0 005	0 00?
19	Shaft Radial Play (Max)2/	Inch	0 0004	0 00	0 001	0.001	0 001	0 00?	0.001	0 001	0 00?

NOTES: 1. [illegible] for the applicable operating [illegible] of Specification MIL-R-14346(MU)
2. Shaft Radial [illegible]

MIL-R-14346A(MU)

4 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 Supplier.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.2 General provisions.- The quality assurance provisions of this specification and of other documents referenced herein form the basis for inspection to be performed by the supplier. Definitions of inspection terms not otherwise defined herein shall be as listed in MIL-STD-109.

4.1.3 Test and inspection facilities.- Test equipment and inspection facilities shall be of sufficient accuracy, quality and quantity to permit the required inspection. The supplier shall establish inspection equipment to the satisfaction of the Government.

4.2 Inspection conditions and methods.

4.2.1 Inspection conditions.- Unless otherwise specified herein all examinations and tests shall be performed at 20° to 35°C at a barometric pressure of 28 to 31 inches of mercury and at a relative humidity of 45 to 75 percent.

4.2.2 Test voltage and frequency.- The test voltage and frequency shall be as specified in Table I. Tolerance on test voltage and frequency shall be as specified on the applicable test figure.

4.2.3 Stabilized operating temperature.- The stabilized operating temperature is reached when the d.c. resistance of a secondary winding does not change more than 0.5 percent over a period of 15 minutes while one primary winding is energized at the test voltage and frequency.

4.2.4 Test temperature condition.- Test temperature condition has been reached when a resolver has been energized at the test voltage and frequency for the same length of time required to bring a resolver with the same type designation number to stabilized operating temperature.

4.3 First article tests.- Unless otherwise specified, the requirements and tests of Table III shall be conducted on first article samples only. Failure of any first article sample shall be cause for disapproval and subsequent action as required by the contract clauses applicable to first article testing.

4.4 Quality conformance inspection.

4.4.1 Acceptance inspection.- Acceptance inspection shall consist of groups A and B inspection.

4.4.1.1 Inspection lot.- Inspection lot shall consist of all the resolvers of one type produced under substantially the same conditions and offered for inspection at one time.

4.4.1.2 Group A inspection.- Group A inspection shall consist of the examinations and tests specified in Table II and shall be on the same set of sample units.

4.4.1.2.1 Sampling plan - Statistical sampling and inspection shall be in accordance with MIL-STD-105.

4.4.1.3 Rejected lots.- If an inspection lot is rejected, the supplier shall withdraw the lot. The supplier may screen out defectives or rework the lot and submit it again for acceptance inspection

TABLE II - Group A Inspection

Test		Requirement Paragraph	Test Paragraph	AQL (per hundred) Major	AQL (per hundred) Minor
Visual and dimensional			4.5	1.0	4.0
Continuity		3.5.12	4.6.1	1.0	—
Friction torque		3.5.10	4.6.2	1.0	4.0
Resolver zero marking		3.5.18	4.6.6	—	4.0
Current		3.5.3	4.6.3		
Power		3.5.4	4.6.4		
COMPENSATION	Null voltage	3.5.15.1	4.6.15.1		
	Winding phase	3.5.15.2	4.6.15.2		
	Equality of windings	3.5.15.3	4.6.15.3		
	Resistor	3.5.15.4	4.6.15.4		
Phase rotation		3.3.3	4.6.7		
Harmonic distortion		3.5.20	4.6.8		
Perpendicularity of axes		3.5.17	4.6.10		
Fundamental null voltage		3.5.9	4.6.9		
Total null voltage		3.5.9	4.6.9	1.0	
Transformation ratio		3.5.14	4.6.11 thru 4.6.11.2		
Nominal phase shift		3.5.13.1	4.6.12		
Variation due to rotation		3.5.13.2	4.6.12.2		
Variation due to voltage		3.5.13.3	4.6.12.3		
Function error		3.5.8	4.6.13 thru 4.6.13.2		
Equality of transformation ratio		3.5.14.2	4.6.11.4		
High potential		3.5.5	4.6.16		
Insulation resistance		3.5.6	4.6.17		
Dielectric		3.5.7	4.6.18		

4.4.1.4 Group B inspection.- Group B inspection shall consist of the tests specified in Table III. A total number of three (3) samples per order shall be submitted from the first lot and from units that have passed Group A inspection. On approval of the procuring activity, the contractor may substitute certified test data in lieu of testing for Group B inspection provided the data has been accumulated from a previous order of the same type being submitted for inspection and the data is derived from items produced within two years of the current order date. The certification shall also provide a statement as follows. "As the authorized representative of the supplier, the undersigned warrants and represents that All the information supplied herewith is true and accurate and meets the requirements for certification of conformance to Group B inspection of MIL-R-14346A(MU)".

4.4.1.4.1 Disposition of sample units.- Sample units which have been tested for Group B inspection shall not be delivered on the contract or order.

4.5 Visual and mechanical.- The resolver shall be inspected visually to determine that the dimensions, markings and finishes conform to the requirements specified herein. The resolver shall also be examined for cleanliness, tightness of fittings and general appearance.

TABLE III - Group B Inspection

Test	Requirement Paragraph	Test Paragraph
Impedance	3.5.16	4.6.5
Drift of resolver zero	3.5.19	4.6.14
Voltage range vs. transformation ratio	3.5.14.1	4.6.11.3
Voltage range vs. phase shift	3.5.13.3	4.6.12.3
Radio noise	3.5.20	4.6.19
Temperature rise	3.5.21	4.6.20
Low temperature operating tests	3.6.5	4.6.21
High temperature operating tests	3.6.5	4.6.22
Extreme temperature tests	3.6.5	4.6.23
Vibration	3.6.2	4.6.24
Shock	3.6.3	4.6.25
Endurance	3.6.1	4.6.26
Humidity	3.6.4	4.6.28
Retests	3.8	4.6.27

4.6 Test procedures.

4.6.1 Brush-slip ring continuity - The shaft shall first be rotated for several revolutions. With a Wheatstone Bridge or any other approved method across the terminals of each rotor winding, the continuity through the brushes and slip rings shall be determined. The test shall be made while the rotor is being slowly turned at a speed not faster than 5 rpm for not less than two revolutions in each direction and shall conform to 3.12.

4.6.2 Friction torque.- This test shall be performed using a balanced dial or a pointer which, when mounted on the resolver shaft, shall exert a torque not greater than the value specified in 3.5.10 at a temperature of 22.5 ± 3.0°C (75 ± 10°F). With the dial or pointer mounted on the shaft, the stator shall be rotated at a rate not faster than 6 rpm with the shaft in a horizontal position; at least two revolutions of the stator shall be made in each direction. The specified torque value shall be considered exceeded if the dial or pointer turns one revolution.

4.6.3 Input current.- With maximum input voltage applied to the primary winding and the secondaries open, the input current shall be measured with an ammeter having an accuracy of at least 1%. (See 6.6)

4.6.4 Power.- The series capacitor used in this test shall be of value to series resonate the resolver winding.

4.6.4.1 Rotor excited units.- For rotor excited units the resolver is connected as shown in Figure 4.

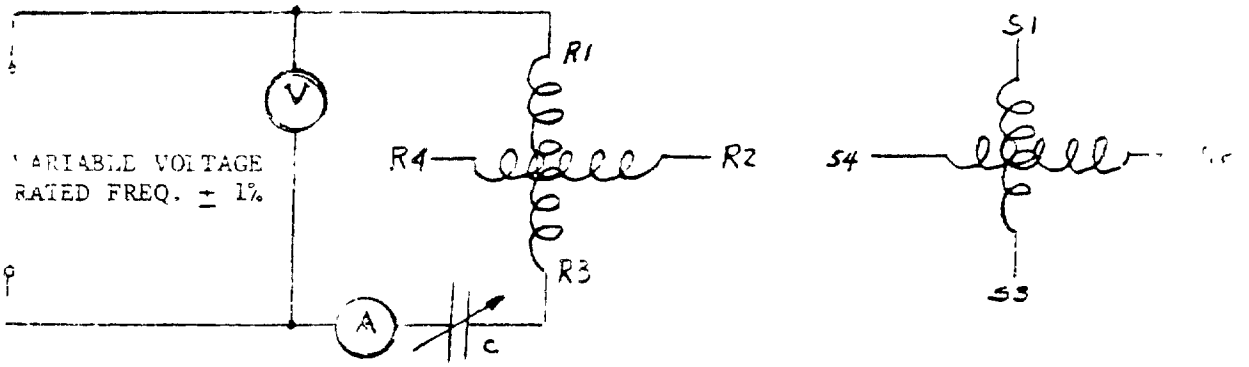


Figure 4

The variable input voltage is gradually raised until 20% of the current measured in 4.6.3 is obtained. "C" is adjusted to produce a maximum current indication. The input voltage is then varied to produce the maximum current measured in 4.6.3. The last two steps are repeated until maximum current is obtained for an optimum adjustment of "C" The power is computed from

$$P = (V-(Rm)I,$$

where V is the reading of the voltmeter
I is the ammeter reading
Rm is the resistance of the ammeter and leads

A suitable wattmeter (or any other approved method) can be substituted for the voltmeter, ammeter and capacitor of Figure 4, with the specified maximum input voltage applied (see 3.1).

CAUTION Because of the large voltages produced by series resonance, it is recommended that input voltages be varied with care.

4.6.4.2 Stator excited units.- For stator excited units the resolver is connected as shown in Figure 5. The same procedure is followed as in 4.6.4.1.

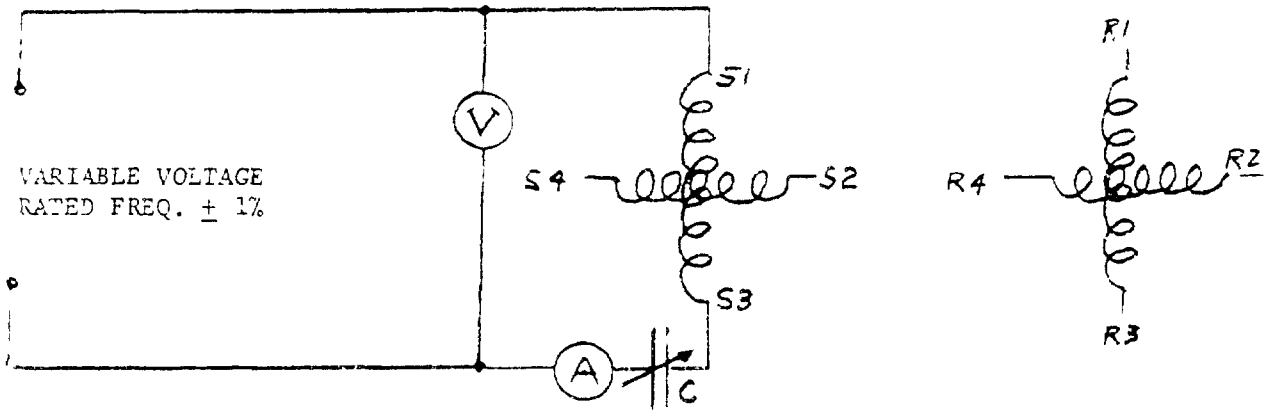
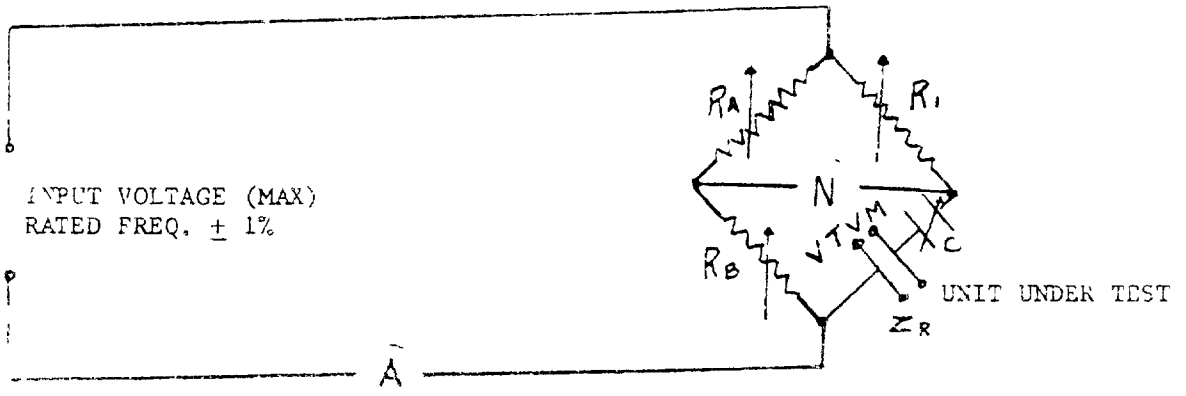


Figure 5

4.6.5 Impedance.- The resolver shall be mounted centrally on a square aluminum plate in accordance with Figures 19 and 20 and excited until thermal stabilization is reached. The series resonance bridge shown in Figure 6 shall be used to obtain the following impedance measurements.



Where Z_R = resolver impedance and $R_A + R_B$ = 10,000 ohms.

Figure 6

4.6.5.1 Rotor impedance, stator open-circuited (Z_{RO}).- The impedance of each rotor winding shall be measured separately with the remaining rotor shorted and the stator windings open-circuited. Z_{RO} shall conform to 3.5.16.1.

4.6.5.2 Stator impedance, rotor open-circuited (Z_{SO}).- The impedance of each stator winding shall be measured separately with the remaining stator shorted and the rotor windings open-circuited. Z_{SO} shall conform to 3.5.16.2.

4.6.5.3 Rotor impedance, stator short-circuited (Z_{RSS}).- The impedance of each rotor winding shall be measured separately with the remaining rotor shorted and the stator windings shorted. Z_{RSS} shall conform to 3.5.16.3.

4.6.5.4 Compensator impedance, rotor open-circuited (Z_{CO}).- The impedance of each compensator winding shall be measured separately with the remaining compensator winding shorted and the rotor windings open-circuited. Z_{CO} shall conform to 3.5.16.4.

4.6.6 Resolver zero.

4.6.6.1 Coarse resolver zero - rotor excited.- For rotor excited units the resolver is connected as shown in Figure 7. The rotor is rotated until a minimum reading is obtained on the voltmeter. The relative position of the arrow stamped on the frame to the index on the shaft shall conform to 3.5.18.

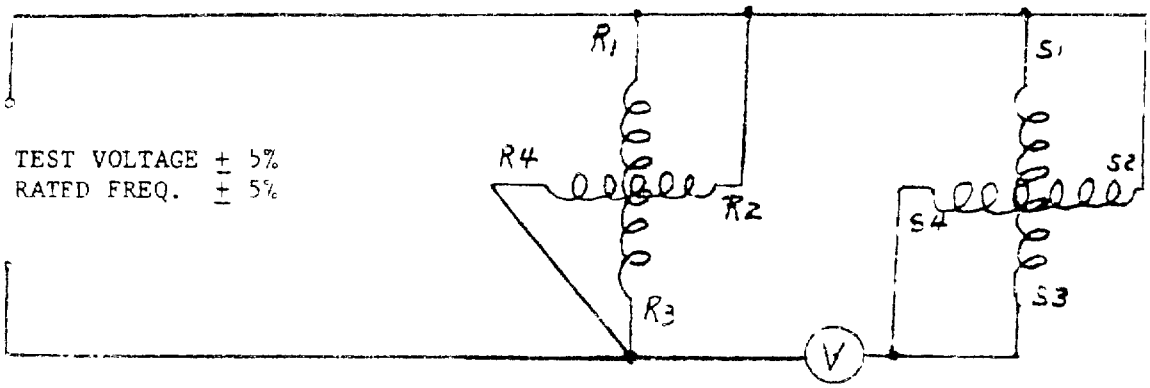


Figure 7

4.6.6.2 Coarse resolver zero - stator excited.- For stator excited units the resolver is connected as shown in Figure 8. (See 4.6.6.2.1).

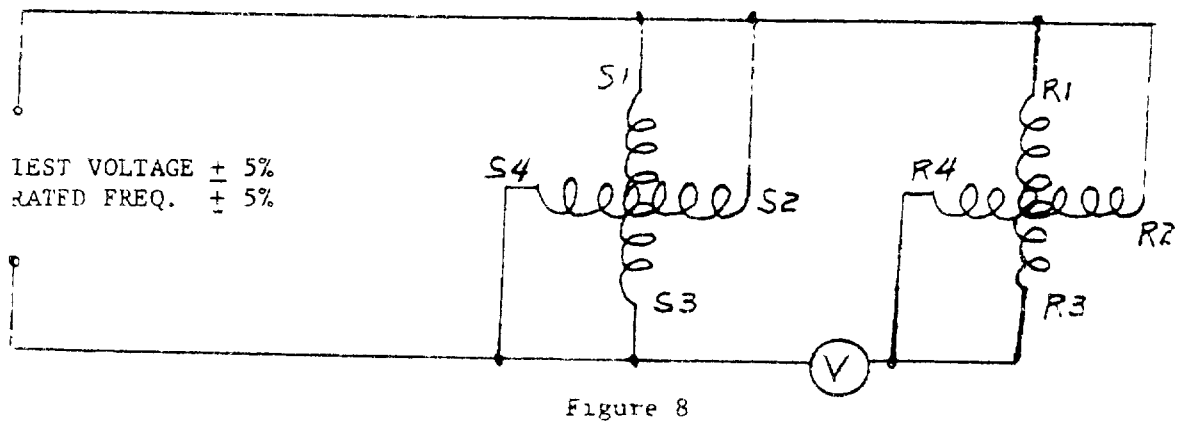


Figure 8

The same procedure is followed as in 4.6.6.1.

4.6.6.2.1 Special case - 23R6R4.- For resolver 23R6R4, the test circuit is connected as shown in Figure 9. The same procedure is followed as in 4.6.6.1.

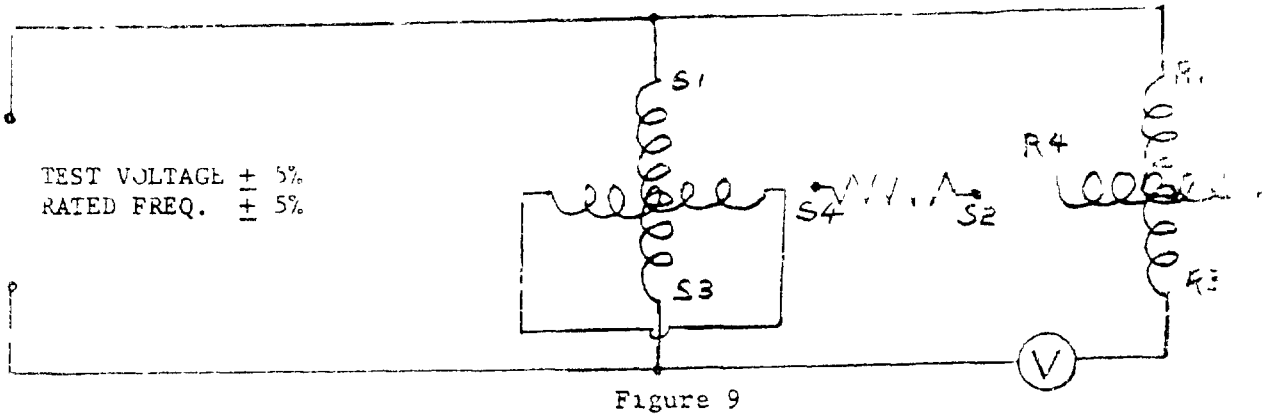


Figure 9

4.6.7 Phase rotation.- The unit is placed in the angular accuracy stand for the following tests:

4.6.7.1 Rotor excited units - (R1-R3 winding).- For rotor excited units the resolver is connected as shown in Figure 10.

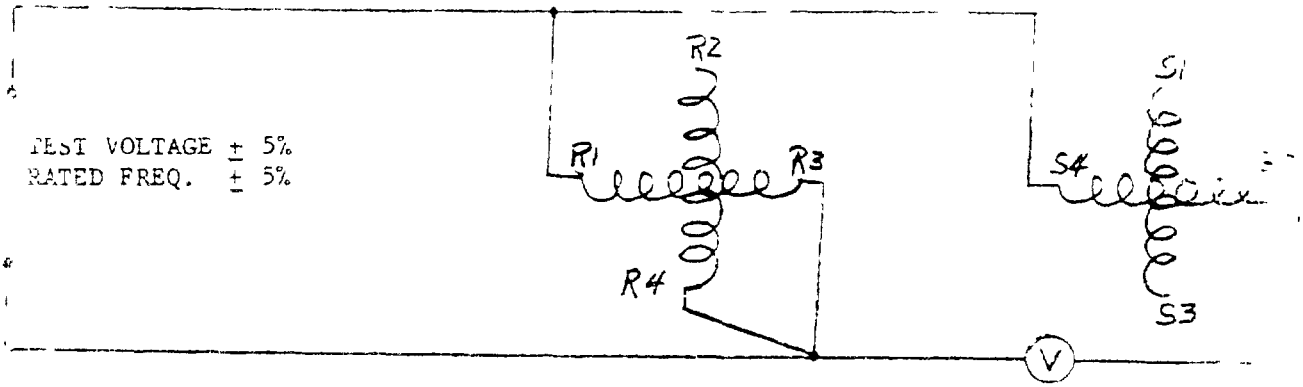


Figure 10

When the resolver shaft is rotated to the 90° position, the voltmeter reading shall conform to 3.3.3.

4.6.7.2 Rotor excited units - (R2-R4 winding).- The same procedure is followed as in 4.6.7.1 except that the resolver is connected as shown in Figure 11.

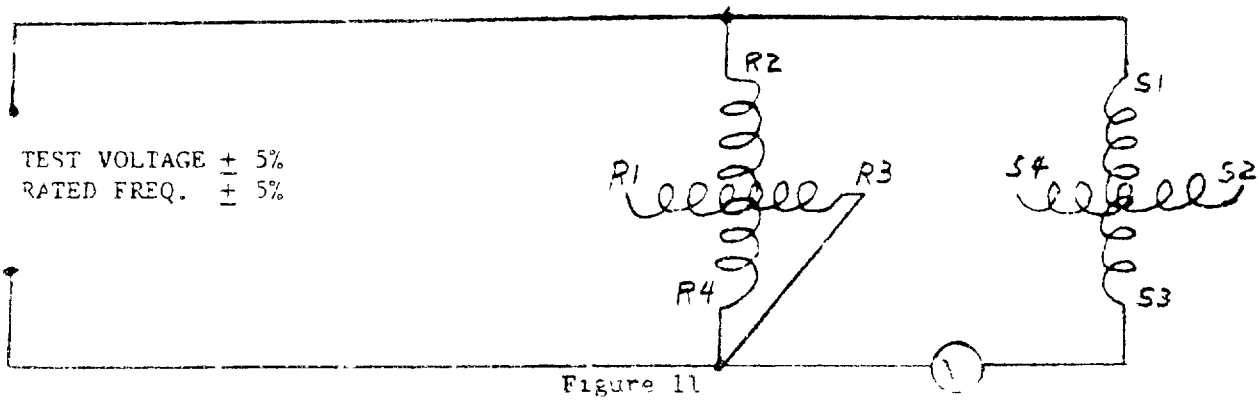


Figure 11

4.6.7.3 Stator excited units - (S1-S3 winding).- The same procedure is followed as in 4.6.7.1 except that the resolver is connected as shown in Figure 12.

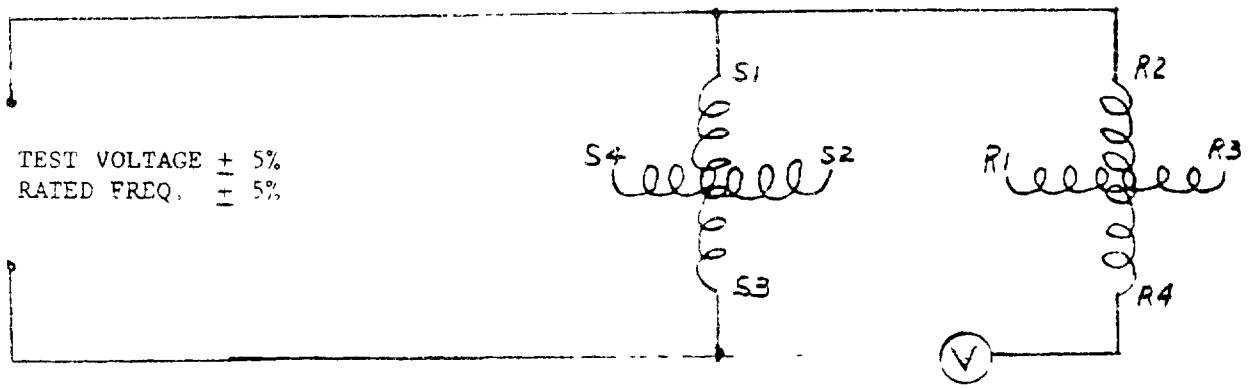


Figure 12

4.6.7.4 Stator excited units - (S2-S4 winding).- The same procedure is followed as in 4.6.7.1 except that the resolver is connected as shown in Figure 13.

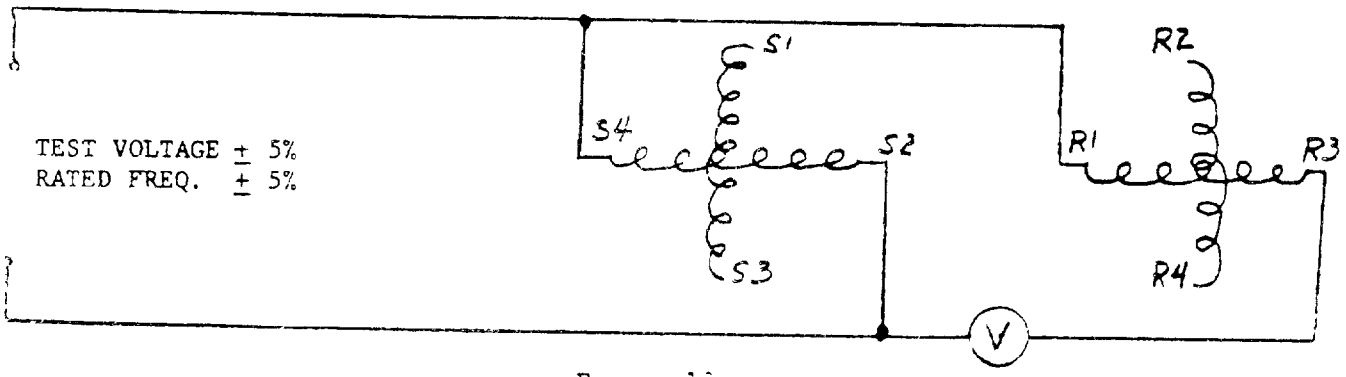


Figure 13

4.6.8 Harmonic distortion.

4.6.8.1 Rotor excited units.- For rotor excited units the resolver is connected as shown in Figure 14. The harmonic distortion shall be measured at the 90° position and shall not exceed the specified limit in 3.5.20.

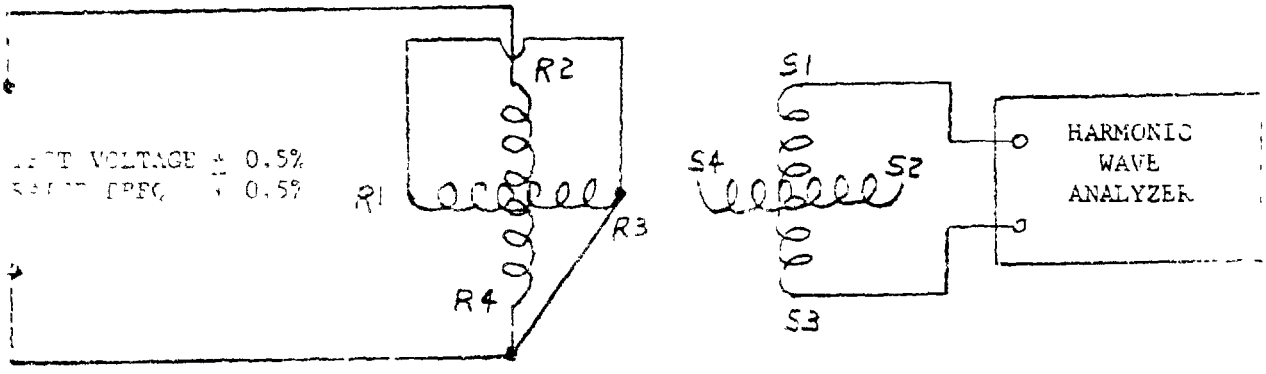


Figure 14

4.6.8.2 Stator excited units.- The same procedure is followed as in 4.6.8.1 except that the resolver is connected as shown in Figure 15.

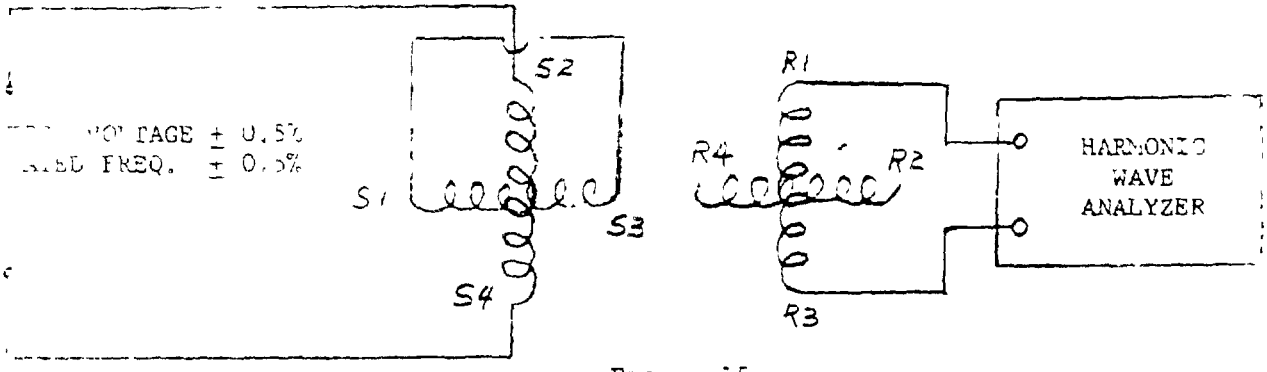


Figure 15

4.6.9 Null voltage test.- Fundamental and total null voltages shall be measured across the terminals indicated, and at the electrical angles indicated in Table IV when the resolver is energized according to 4.2.3 and 4.2.4 across one of the applicable pairs of primary terminals. Null voltages shall be measured at the specified test voltage by the method of either 4.6.9.1 or 4.6.9.2, at the option of the supplier. The voltage measuring instruments used shall indicate the value of the voltage in terms of the rms value of an equivalent sine wave and shall have

input impedance equal to that of a 500,000 ohm resistor shunted by a 30 pF capacitor. Fundamental and total null voltages at any test position shall be in accordance with 3.6.8. This test shall be repeated, except that the other applicable pair of primary terminals shall be energized.

4.6.9.1 Frequency-sensitive voltmeter method.- A frequency-sensitive voltmeter shall be used which has a fundamental frequency filter with a change of output voltage not to exceed ± 0.5 percent for a change of ± 1 percent in excitation frequency. The output voltage shall also be at least minus 30 decibels (db) at half and twice rated frequency. The meter shall be properly compensated for the insertion loss of the filter. Turn the resolver rotor until a minimum voltage is obtained on the frequency-sensitive voltmeter. This voltage is the fundamental component of the null voltage. Without disturbing this rotor position, measure the total null voltage with a vacuum tube voltmeter.

4.6.9.2 Phase-sensitive voltmeter method.- Turn the resolver rotor until the inphase component of the null voltage is zero as indicated on a phase-sensitive voltmeter. Read the quadrature voltage. This voltage is the fundamental component of the null voltage. Without disturbing this rotor position, measure the total null voltage on a vacuum tube voltmeter.

TABLE IV

Connections and Angular Displacement for Null Voltage Test and Interaxis Error Test

		Null Voltage Test		
Unit	Primary Voltage	Across Terminals	At Electrical Angles	Positions
Rotor Excited	R1-R3	S2 to S4 S1 to S3	0° and 180° 90° and 270°	1, 2 3, 4
	R2-R4	S1 to S3 S2 to S4	0° and 180° 90° and 270°	5, 6 7, 8
Stator Excited	S1-S3	R2 to R4 R1 to R3	0° and 180° 90° and 270°	1, 2 3, 4
	S2-S4	R1 to R3 R2 to R4	0° and 180° 90° and 270°	5, 6 7, 8

4.6.10 Perpendicularity of axes.- The resolver shall be mounted in a test stand capable of positioning the resolver rotor to any given angle within 15 seconds of arc. One of the applicable pairs of primary terminals listed in Table IV shall be energized according to 4.2.2 and 4.2.4. The rotor shall be positioned to the angles specified in Table IV. At each position the rotor shall be adjusted to the nearest null and the angle indicated by the test stand noted. The test shall be repeated, except

that the other applicable pair of primary terminals shall be energized. The algebraic difference between the deviations from the tabulated angles at the various positions indicate the interaxis errors as follows.

Secondary winding; Positions 1 and 3, 2 and 4, 5 and 7, 6 and 8.
Primary windings; Positions 1 and 7, 2 and 8, 3 and 6, 4 and 5.
Resolver, Positions 1 and 5, 2 and 6, 3 and 7, 4 and 8.

Perpendicularity of axes shall be in accordance with 3.5.17.

4.6.11 Transformation ratio test.

4.6.11.1 Rotor excited.- The resolver, mounted in the applicable test fixture shown in Figure 19 or 20, shall be energized at terminals R1-R3 under the test conditions of 4.2.2 and 4.2.4. The output at terminals S1-S3 shall be measured at the position of maximum coupling nearest resolver zero. The measuring instrument used shall indicate true rms voltage of the fundamental frequency, and shall not alter the open circuit secondary voltage by more than 0.1 percent. The rotor shall be turned 90 degrees counterclockwise, and the output at terminals S2-S4 measured at the nearest position of maximum coupling. The resolver shall then be energized at terminals R2-R4. The outputs at S2-S4 and at S1-S3 shall be measured at the positions of maximum coupling nearest 0 degrees and 90 degrees respectively. The ratios of output voltages to input voltages are the transformation ratios of the pairs of windings. The transformation ratio of each set of windings shall be in accordance with 3.5.14.

4.6.11.2 Stator excited.- Test conditions of 4.11.1 applies for stator excited resolvers, except that the following substitutions shall be made when connecting terminals, S1-S3 for R1-R3, S2-S4 for R2-R4, R1-R3 for S1-S3, and R2-R4 for S2-S4.

4.6.11.3 Variation with input voltage.- The transformation ratios shall be found according to the applicable test conditions of 4.6.11.1, 4.6.11.2 and 4.6.11.4 using the maximum and minimum input voltages specified in the applicable specification sheet. The variation in transformation ratios shall be in accordance with 3.5.14.1.

4.6.11.4 Equality of transformation ratio.- The maximum difference between transformation ratios measured in 4.6.11.1 or 4.6.11.2 as applicable and 4.6.11.4 shall be in accordance with 3.5.14.2.

4.6.12 Nominal phase shift test.

4.6.12.1 Rotor excited.- The resolver shall be energized at terminals R1-R3 under the conditions of 4.2.2 and 4.2.4 with terminals R2-R4 shorted and terminals S1-S3 and S2-S4 open. The rotor shall be turned to the position of maximum coupling between windings R1-R3 and S2-S4 nearest to 90 degrees. The phase shift shall be measured at terminals S2-S4 to an accuracy of ± 1.0 degree, with an instrument having an impedance of not less than that of a 500,000 ohm resistance shunted by a 30 pF (picofarads) capacitance. Phase shift shall be in accordance with 3.5.13.1.

4.6.12.2 Phase shift variation with position.- Using the same test setup as 4.6.12.1 the phase shift shall be measured at 45° increments during one full revolution. Phase shift shall be measured at 10° either side of the 0° or 180° position. Phase shift variation with rotation shall be in accordance with 3.5.13.2

4.6.12.3 Phase shift variation with voltage.- Using the same test setup as 4.6.12.1, the phase shift shall be measured at the first position of maximum coupling, at the minimum and maximum operating voltages specified in the applicable specification sheet. Phase shift variation with input voltage shall be in accordance with 3.5.13.3.

4.6.12.4 Stator excited.- Test conditions 4.6.12.1, 4.6.12.2 and 4.6.12.3 applies for stator excited resolvers except that the following substitutions shall be made when connecting terminals; S1-S3 for R1-R3, S2-S4 for R2-R4, R1-R3 for S1-S3, and R2-R4 for S2-S4.

4.6.13 Function error test.

4.6.13.1 Stator excited.- The resolver shall be mounted in a test stand which can indicate the angular position of the rotor within 15 seconds of arc. Energize terminals S1-S3 in accordance with 4.2.2 and 4.2.4 Align the shaft index approximately with the arrow stamped on the frame. Set the rotor exactly at resolver zero by obtaining a null across terminals R2-R4 using the circuit shown in Figure 17. The resolver shall be connected into the test circuit as shown in Figure 16, or a similar circuit acceptable to the procuring activity. Rotate the rotor to the 90 degree (physical angle) position, set the readout variable transformer to 100 percent. Adjust the normalizing variable transformer and the phase shifter until the minimum null appears across the phase sensitive null detector The phase shifter and normalizing variable transformer shall not be readjusted throughout the remainder of the test. Starting at zero the output shall be measured at 5 degree (physical angle) intervals up to and including 180 degrees. The output shall be measured by the reading on the readout variable transformer, when it is adjusted to indicate a null on the phase sensitive null detector. The difference between the reading at each position and the sine of the rotor angle, expressed as a percentage of maximum output, is the function error. The test shall be repeated, except that the following terminal substitutions shall be made when making connections, S2-S4 for S1-S3, and R1-R3 for R2-R4. The function error at any position shall be in accordance with 3.5.8.

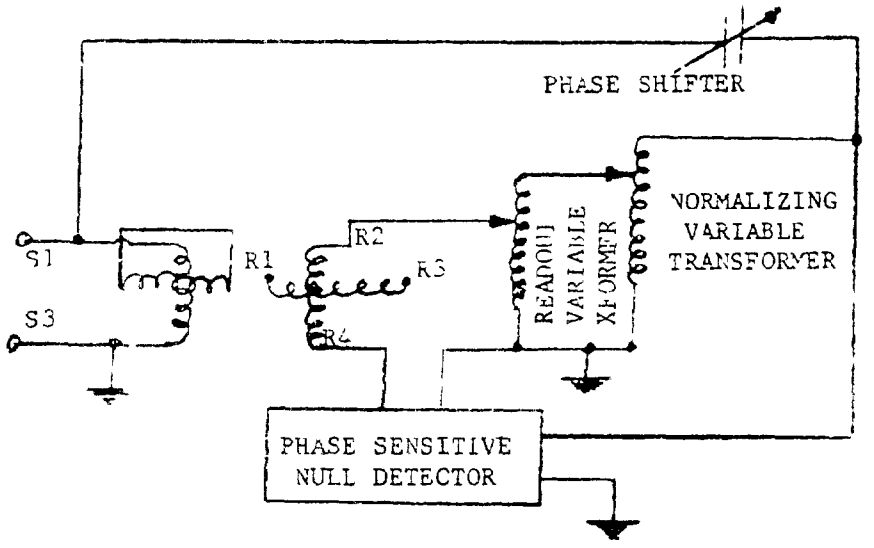


Figure 16

4.6.13.2 Rotor excited.- Test conditions of 4.6.13.1 applies for rotor excited resolvers, except that the following terminal substitution shall be made when making connections, R1-R3 for S1-S3, R2-R4 for S2-S4, S1-S3 for R1-R3, and S2-S4 for R2-R4. Figure 18 shall be used to find resolver zero.

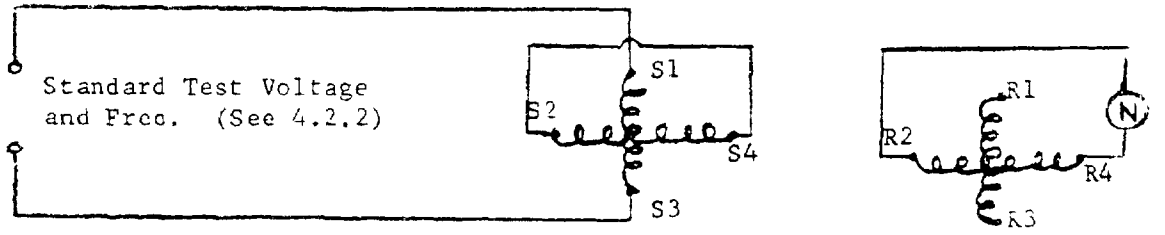


Figure 17

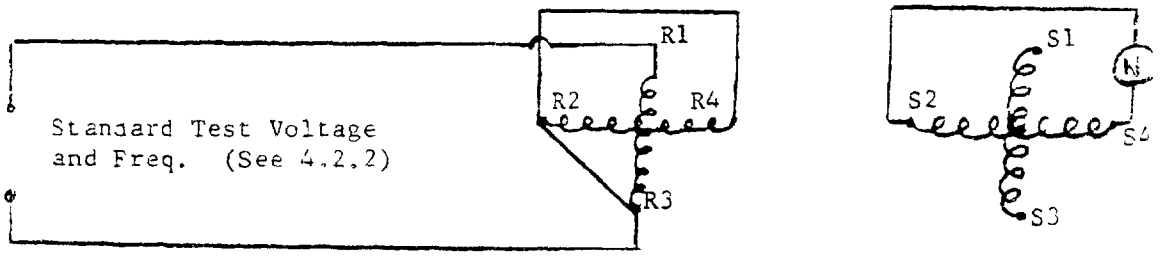
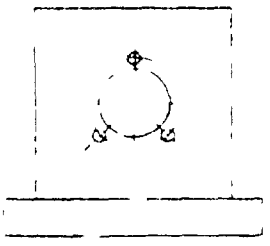
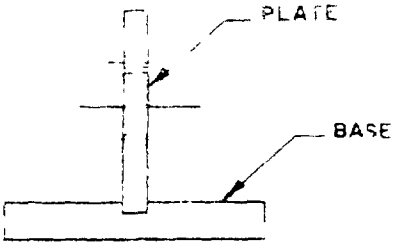
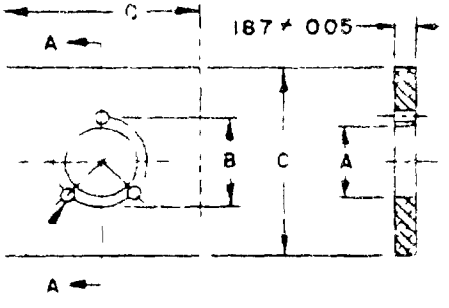


Figure 18





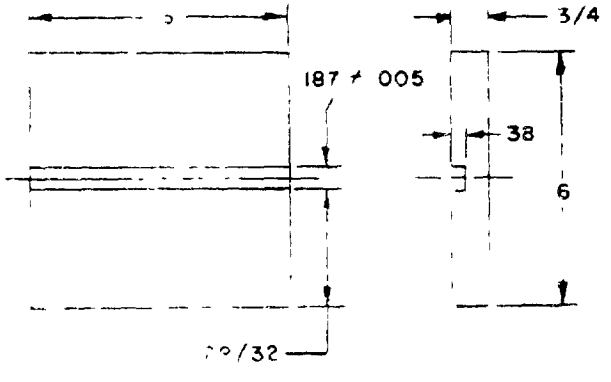


Size	A	B	C
15	1.313	1.534	3.936

4-40 THREAD, 3 HOLES
EQUALLY SPACED ON DIA B

PLATE

MATERIAL ALUMINUM, 24ST 4, SPEC QQ-A-355
FINISH ANODIZE TYPE II DYED BLACK, SPEC MIL-A-8625
TOLERANCES ON LETTERED DIMENSIONS, ± 010 - 000

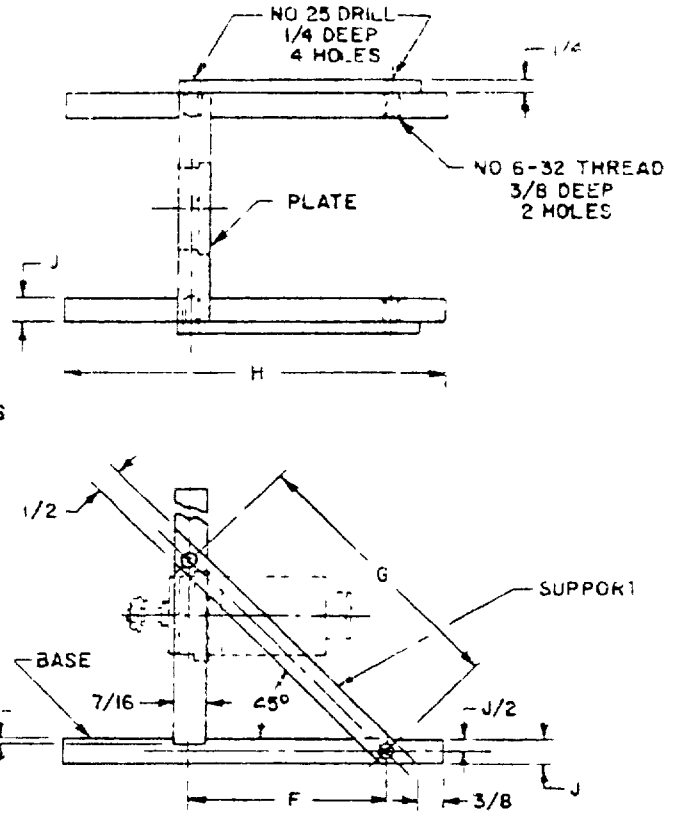


BASE

MATERIAL THERMALLY INSULATING

TOLERANCES ON FRACTIONS,
± 1/64 UNLESS
OTHERWISE SPECIFIED

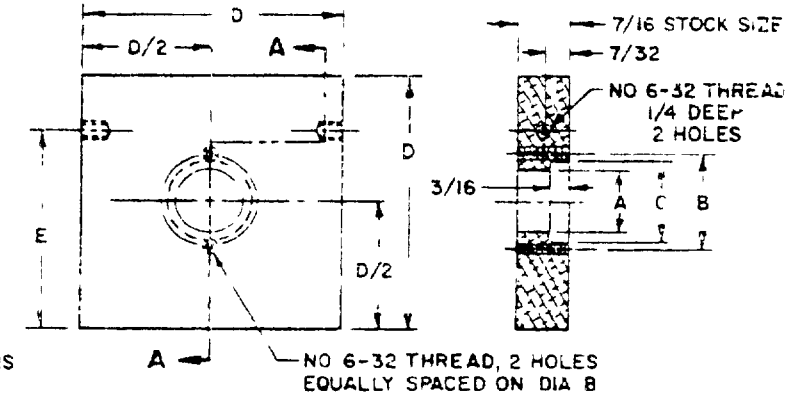
Figure 19. Test Stand for 1.90" Diameter and Smaller



BASE AND SUPPORT

MATERIAL THERMALLY INSULATING

TOLERANCES ON LETTERED DIMENSIONS ±.010, -.000, ON FRACTIONS, ± 1/64; ON ANGLES, ± 1°



PLATE

MATERIAL ALUMINUM, 24ST4, SPEC QQ-A-355

FINISH ANODIZE TYPE II, DYED BLACK, SPEC MIL-A-8625

TOLERANCES ON LETTERED DIMENSIONS ± .010, - .000; ON FRACTIONS, ± 1/64

TABULATION OF LETTERED DIMENSIONS

SIZE OR TYPE	DIM A	DIM B	DIM C	DIM D	DIM E	DIM F	DIM G	DIM H	DIM J	DIM K
23	2.001	3.009	2.280	5.998	4.75	4.875	6.892	9.00	3/4 - 3/4	.40

Figure 20. Test Stand, 2.250 Dia and Larger

4.6.14 Shift of resolver zero test.

4.6.14.1 With voltage variations.- The resolver shall be mounted on an angular test stand capable of positioning the resolver rotor to any given angle within 15 seconds of arc. The resolver shall be connected into the applicable test circuit of Figure 7 or 8. The resolver and test stand shall be zeroed for the test voltage and frequency specified in the applicable specification sheet. The resolver shall also be zeroed at the maximum and minimum operating voltages specified, and the shift in resolver zero recorded for each voltage. Shift in resolver zero with voltage variation shall be in accordance with 3.5.19.

4.6.14.2 With frequency variations.- The foregoing test shall be repeated, except that the voltage shall be held at the specified applicable voltage and the resolver shall be zeroed at the operating frequency -10% and at the operating frequency + 10 percent. The shift in resolver zero shall be recorded for each frequency. Shift in resolver zero with frequency variation shall be in accordance with 3.5.19.

4.6.15 Compensation.

4.6.15.1 Null voltage.- When the resolver is connected as shown in Figures 21 and 22, the reading of the null meter shall conform to 3.5.15.1.

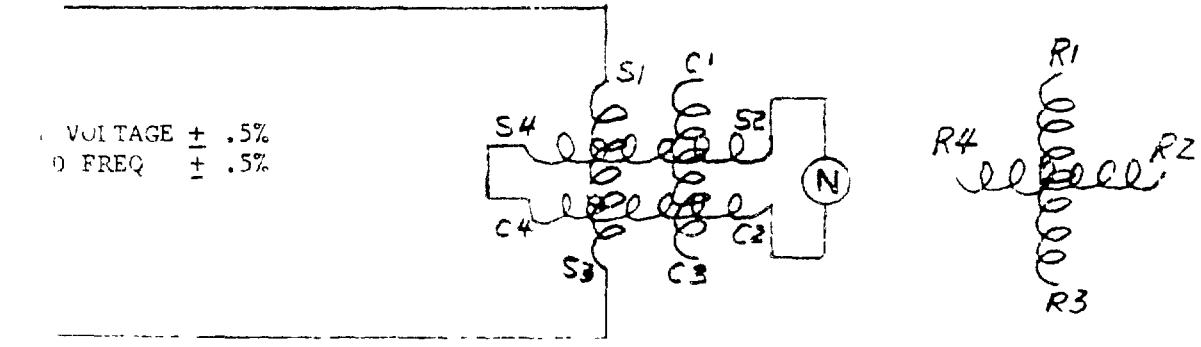


Figure 21

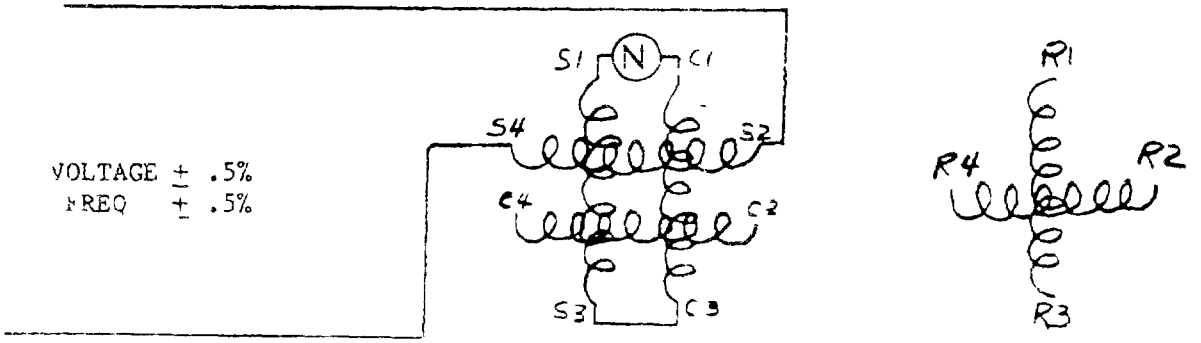


Figure 22

4.6.15.2 Winding phase. When the resolver is connected as shown [illegible] and 24, the reading of the voltmeter shall conform to 3.5.15.2.

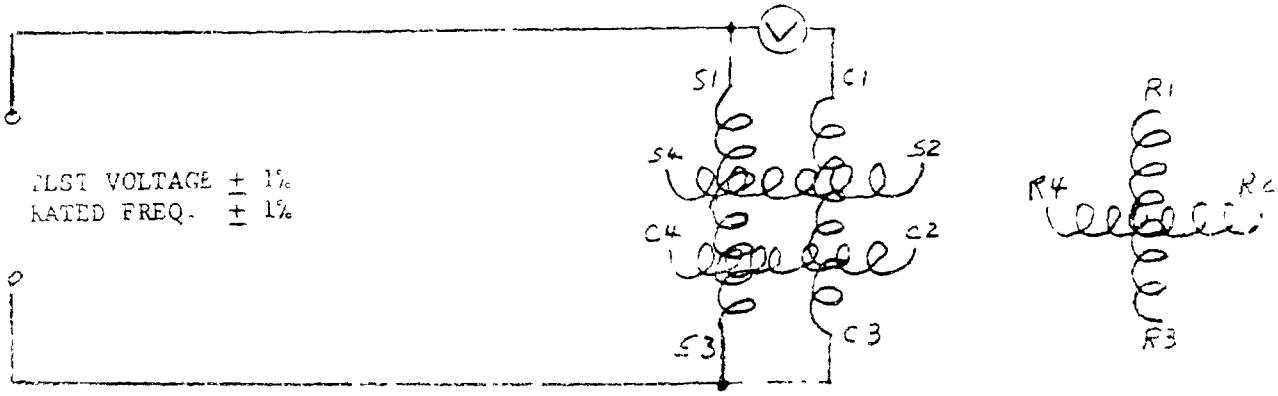


Figure 23

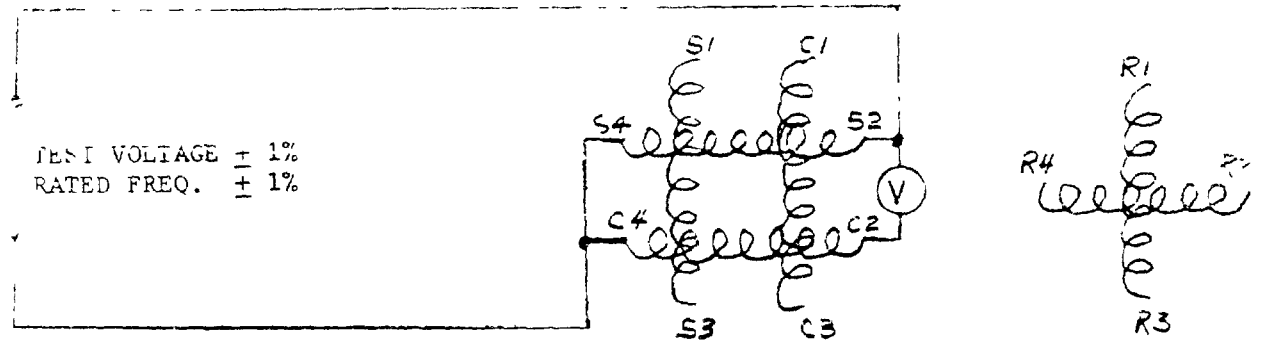


Figure 24

4.6.15.3 Equality of compensating windings.- When the resolver is connected as shown in Figure 25, the reading of the null meter shall conform to 3.5.15.3.

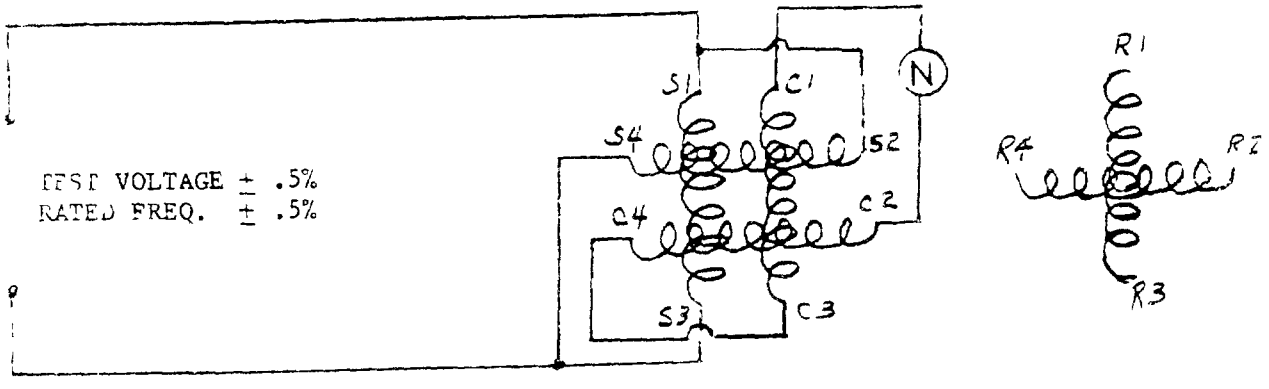


Figure 25

4.6.15.4 Compensating resistor.- When applicable, the compensating resistor shall be checked for the proper value, material, and terminal markings, as specified (see 3.5.15.4).

4.6.16 High potential.- Unless otherwise specified, the high potential test voltages shall be in accordance with Table V

TABLE V

Unit Size	Location	Test Voltage (rms) 1/
15	winding to frame	500
15	between isolated windings	500
22	winding to frame	900
23	between isolated windings	500

The relative humidity for this test shall not be less than 50%. After the test voltage has been raised slowly (approximately 100 volts per second) to the specified value and held at that value for one minute, the resolver shall meet the requirements of 3.5.5. This test shall be immediately followed by the Insulation Resistance Test, 4.6.17.

4.6.17 Insulation resistance.- The insulation resistance test shall be made by means of a megohm bridge (or any other approved means) with a d.c. test voltage of 400 volts applied between windings and between windings and case. The value of insulation resistance shall conform to 3.5.6.

4.6.18 Dielectric test.- The resolver primary shall be energized as indicated in Table VI with twice the rated frequency and with no load on the secondaries.

TABLE VI

Type Unit	Primary Terminals	Primary Voltage ± 5%	Shorted Terminals
Rotor energized	R1-R3	1.4 max. input	R1 to R2
Stator energized	S1-S3	1.4 max. input	S1 to S2 S3 to S4
23R6R4	S1-S3	2 max input	None

After the shaft has been rotated at least one revolution at less than 5 rpm, the resolver shall meet the requirements of 3.5.6.

1/ Test voltage may be either 60 or 400 cycles

4.6.19 Radio noise.- The resolver shall be energized as indicated in Table VII and its rotor rotated at 1150 ± 50 rpm. The rod antenna of a noise meter shall be placed within 3 ± .3 feet of the resolver brushes and the noise level measured at no less than two frequencies in each of the bands between 0.15 and 150 megacycles. The noise level shall not exceed the requirements of 3.5.21.

4.6.20 Temperature rise.- The unit under test shall be clamped in an aluminum plate in accordance with Figures 19 or 20 in a space which is free from drafts (velocity less than 1 ft/sec) and in an ambient temperature of 22.0 ± 3.0°C (75 ± 10°F). Connections shall be in accordance with Figure 26 and Table VIII.

TABLE VII

Type Unit	Primary	Primary Voltage ± 5%	Shorted Terminals	Secondary Loading
Rotor energized	R1-R3	.707 max. input	R1-R2	open
Stator energized	S1-S3	.707 max. input	S1-S2 S3-S4	1000 ohms ea.
23R6R4	S1-S3	max. input	None	1000 ohms ea.

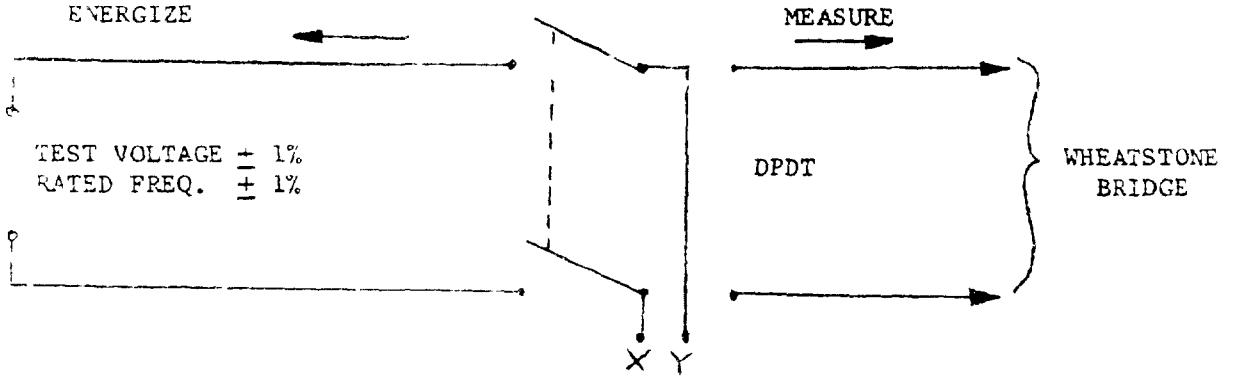


Figure 26

TABLE VIII

Type Unit	Primary Shorting Connection	X-Y	Voltage
Rotor energized	R1-R2	R1-R3	.707 max. input
Stator energized	S1-S2 S3-S4	S1-S3 S1-S3	.707 max. input
23P6R4	None	S1-S3	max. input

With the switch in "Measure" position, the resistance (R_c) of the specified resolver windings shall be determined by means of a Wheatstone Bridge. The ambient temperature shall be recorded for this resistance value with a thermometer (accurate to $1^{\circ}C$) placed within 6 ± 1 inches of the unit. With the switch in "Energize" position, the unit shall be excited for at least 5 hours. The ambient temperature shall be recorded hourly as at the beginning of the test. At the conclusion of the excitation period, as many resistance readings as possible are obtained within the first 100 seconds of cooling. A resistance-time curve can be extrapolated to obtain the resistance due to temperature rise (R_n). The temperature rise can be calculated from the following equation

$$\Delta T = (234.5 + tc)\left(\frac{Rn}{Rc} - 1\right) - \Delta tc$$

where ΔT = temperature rise (see 3.11)
Rc = resistance of winding measured at beginning of test (tc)
tc = initial ambient temperature ($^{\circ}C$)
Δtc = average of all ambient temperatures minus the initial ambient ($^{\circ}C$)
Rn = resistance of winding measured at end of test

NOTE Any approved temperature rise test can be used in lieu of the specified test.

4.6.21 Low temperature operating.- The tests of Table IX shall be repeated at $-55.0^{\circ}C$ ($-65^{\circ}F$). (See 3.6.5).

TABLE IX

Test	Paragraph
Perpendicularity of axes	4.6.10
Null voltage	4.6.9
Transformation ratio	4.6.11

TABLE IX (Cont'd.)

Test	Paragraph
Nominal phase shift	4.6.12
Function error and phase shift variation	4.6.12.2 and 4.6.13
High potential	4.6.16
Insulation resistance	4.6.17
Dielectric	4.6.18
Friction torque	4.6.2

4.6.22 High temperature operating.- The tests of Table X shall be repeated at 55°C (125°F). (See 3.6.5).

TABLE X

Test	Paragraph
Perpendicularity of axes	4.6.10
Null voltage	4.6.9
Transformation ratio	4.6.11
Nominal phase shift	4.6.12
Function error and phase shift variation	4.6.12.2 and 4.6.13

4.6.23 Extreme temperature.- The tests of Table XI shall be repeated at 125°C (250°F) after a four hour period of temperature stabilization (see 3.6.5).

TABLE XI

Test	Paragraph
High potential	4.6.16
Insulation resistance	4.6.17
Dielectric	4.6.18

4.6.24 Vibration test.- The resolver shall be mounted rigidly to a vibration stand with the shaft vertical, its extended end at the bottom and free to rotate. The unit shall be energized and loaded as indicated in Table VII and Figure 27 and then vibrated simultaneously in the vertical and horizontal directions with a sinusoidal total amplitude of 0.10 ± 0.02 inches. The frequency of vibration shall vary linearly from 10 cps to 60 cps with a period of one minute. The total time of vibration shall be 8 hours ± 15 minutes. Periodic checks of brush-slip ring continuity shall be measured (see 4.6.1) during this test with the primary excitation and rotor loads disconnected. (Contacts "b" and "c" of DPST switch are not used for rotor excited units). After the test the rotor and bearings shall be removed and examined for conformance with 3.6.2.

4.6.25 Shock.- The resolver shall be mounted in accordance with Method 202 of MIL-STD-202, and energized and loaded as indicated in Table VII. The unit shall be subjected to 6 blows of 100 G each; 3 blows shall be struck with the shaft vertical, its extended end at the bottom and free to rotate, 3 blows shall be struck with the shaft horizontal and free to rotate after which resolvers shall conform to 3.6.3.

4.6.26 Endurance.- All units submitted for tests shall be given a continuous endurance run of 1000 ± 10 hours at 1150 ± 50 rpm while energized and loaded as indicated in Table VII. The first 64 hours of this test shall be made at a temperature of -25°C (-15°F) with the shaft of the unit horizontal. The next 96 hours of the test shall be made at a temperature of 55°C (125°F) and operated in each of the following positions for 24 hours

(a) Shaft vertical, upward
(b) Shaft inclined 45° upward
(c) Shaft inclined 45° downward
(d) Shaft vertical, downward

The remaining time of the test shall be consumed by running the unit with the shaft horizontal and at room temperature. The units shall then be disassembled and checked for conformance to 3.6.1.

4.6.27 Retests.- After all preceding tests have been completed, the following tests shall be repeated: 4.6.8, 4.6.9, 4.6.10; 4.6.11.3 4.6.12, 4.6.13, 4.6.15 and 4.6.16.

4.6.28 Humidity.- The resolver shall be subjected to the humidity test in accordance with Method 103 of MIL-STD-202, test condition A. After the test, the rotor, bearings, and bearing shields shall be removed and examined for evidence of rust, blistering varnish condensates or corrosion (see 3.6).

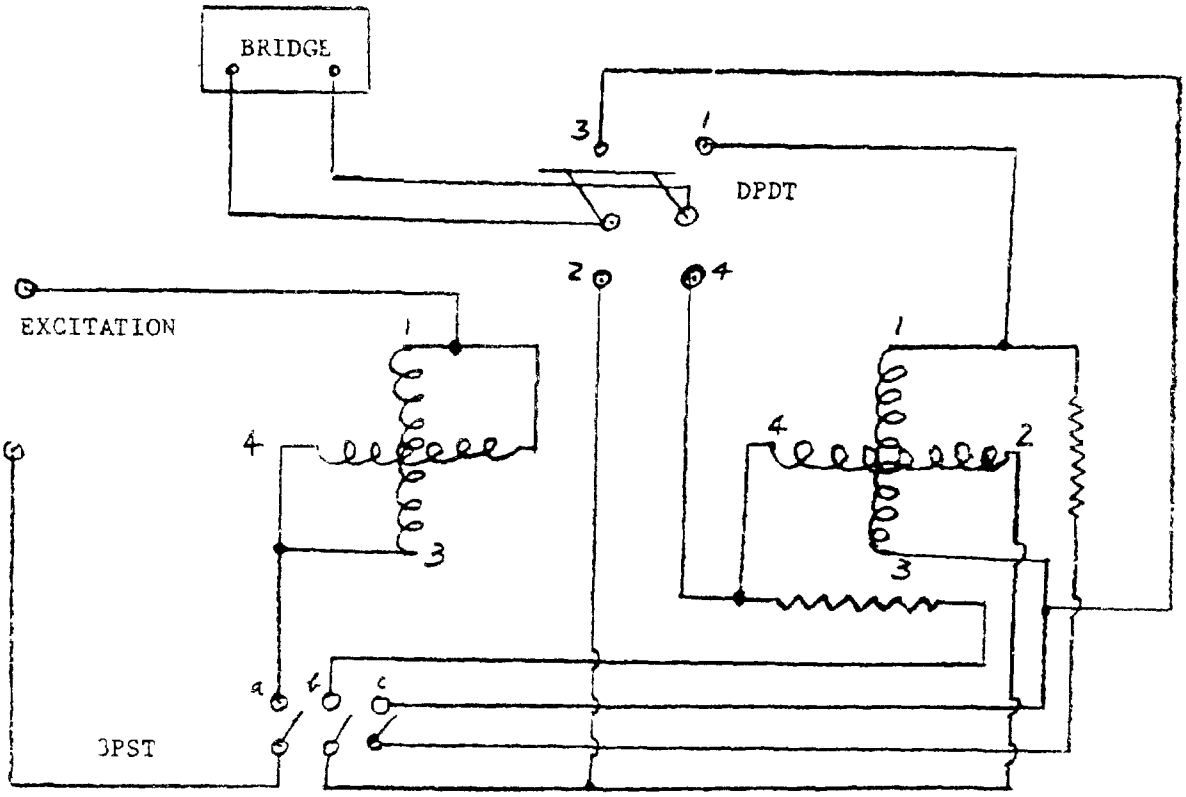


Figure 27

4.7 Inspection of preparation for delivery.- Inspection for the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing and marking.- Each resolver shall be packaged, packed and marked in accordance with MIL-P-12134.

6. NOTES

6.1 Intended use.- Resolvers covered by this specification are intended for use in military systems for fire control, radar, navigation, guided missiles and other applications requiring precision in transmission or conversion of angular data. Resolvers covered by this specification are intended for maintenance support of in-service material only. For resolvers applicable to new material design see MIL-R-23417

6.2 Ordering data.- Procurement documents should specify the following

(a) Title, number and date of this specification.
(b) Type designation and nomenclature.
(c) If contract number is required on identification plate.
(d) Selection of applicable levels of preservation, packaging and packing.

6.3 Definitions.- Technical terms used in this document are defined in MIL-R-13417.

6.4 Cross-reference between experimental or company designation and type designation.

Experimental or Company Designation	Type Designation
15RS4I	15F7N4
23RS4	23R8N4
23RS4A	*23R3N4
23RS4B	23R6R4
23RS4C	23R32N4
23RS4D	23R32W4
23RS6	23R6N6
23RS6A	23R9N6
23RS6B	23R11R6

*Zero position 90° clockwise from position established in 3.3.1.2

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b Recommended Wording

c Reason/Rationale for Recommendation

6 REMARKS

7a NAME OF SUBMITTER *(Last, First, MI)* – Optional	b WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
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